Rita Roberts

Mechanisms associated with nocturnal elevated thunderstorm initiation during PECAN

rroberts@ucar.edu

Authors

Rita Roberts, National Center for Atmospheric Research,

During the International H_2O Project (IHOP) over the Great Plains of the United States in 2002, approximately half of the thunderstorm episodes were initiated by surface-based convergence lines and the other half were initiated by elevated processes (i.e., no apparent surface-based forcing) and occurred primarily during the night (Wilson and Roberts 2006). The processes associated with elevated thunderstorm initiation are not well understood and during the IHOP experiment there was insufficient vertical profiling observations to conduct basic understanding of the elevated convection initiation process. In the summer of 2015 the Plains Elevated Convection At Night (PECAN) experiment was conducted in the south-central Great Plains of the United States to study elevated initiation events. A large number of facilities were deployed that included radars, instrumented airplanes, wind profilers, sounding systems, lidars and water vapor dials and a suite of mobile radar and mobile profiling platforms.

Nocturnal elevated initiation events during PECAN frequently occurred in association with the isentropic lift of moist southerly air by the low level jet over stationary frontal boundaries. These larger scale events can sometimes be predicted by NWP models, but the location and timing of the convection is difficult to predict. The convection associated with this type of large scale forcing often grew upscale into Mesoscale Convective Systems. Investigated in this study are the less obvious triggers of nocturnal forcing that include elevated gravity waves, localized convection induced by terrain in-homogeneities, the impact of remnant or stalled convergence boundaries from daytime convection on nighttime convection initiation, and the forcing of lines of convection near (50-100 km) existing storm complexes. Some of the most dramatic cases of initiation were like this and not understood at all. Initiation of convection above the nighttime stable layer by these forcing mechanisms are not predictable by NWP models. Particularly challenging to address is whether the PECAN observations were sufficient that one could predict the timing and exact location of mesoscale and local scale initiation events.

In addition to the large array of PECAN instrumentation mentioned above, satellite imagery is also used in this study. This work is a companion to the studies being conducted by Wilson and Roberts (see Wilson and Roberts abstract) on the origin and triggering of nocturnal convection.